Syllabus for Introduction to Real Analysis (Online Math Camp)

Class Time: Monday 9:10-12:10am, at Social Sciences 609 (社科 609 教室)

Instructor: Joseph Tao-yi Wang (josephw "at" ntu.edu.tw) Office: Social Sciences 754

TA: Zong-Hong Cheng (鄭宗弘), Danny Bo-Hsien Kang (康柏賢), Sean Lan (藍士恩)

Office Hours: Monday 9:10-10:00am in class or by email appointment

Class Website: http://homepage.ntu.edu.tw/~josephw/mathcamp_23S.htm

This course cannot substitute "Introduction to Real Analysis I" (分析導論一, 5 units). Instead, this is a flipped online course to help you go through the introduction of (undergraduate) real analysis, focusing on the first five chapter of Rudin's *Principles of Mathematical Analysis*. The purpose is to introduce economics students to point-set topology which forms the foundation of Advanced Calculus, so they can study abstract mathematics required for graduate studies in economics. Students are expected to:

1. **Watch Lecture Videos Online**: Such as 高等微積分@NTU OCW or Francis Su at Harvey Mudd College: http://analysisyawp.blogspot.com/2013/01/lectures.html
2. **Participate In-Class**: Take weekly quizzes of 50 minutes each, which solutions are discussed immediately. Come and ask questions in office hours before the quiz!

Textbook and Other Recommended Reading:

1. Rudin, *Principles of Mathematical Analysis*, 3rd ed., McGraw Hill. (Textbook)
2. Tao, *Analysis I: Third Edition*, Springer. (e-book available through NTU library)
3. Protter and Morrey, *A First Course in Real Analysis*, 2nd ed., Springer.
4. *Interactive Real Analysis*:

Grading: Final Exam (6/5, 50%) and Weekly Quizzes (5% each for 10 highest). When a quiz is taken online, it counts for only 1%; the remaining 4% will be replaced by the final exam. So if all quizzes are taken online, final exam will count as 90%.

Course Outline:

1. [2/20] Lecture 1-2: Constructing the Rational Numbers; Properties of Q
2. [3/ 6] Lecture 3-4: Construction of R; The Least Upper Bound Property
3. [3/13] Lecture 5-6: Complex Numbers; The Principle of Induction
4. [3/20] Lecture 7-8: Countable/uncountable Set; Cantor Diagonalization, Metric Space
5. [3/27] Lecture 9-10: Limit Points; Relationship between Open and Closed Sets
6. [4/10] Lecture 11-12: Compact Sets; Relationship between Compact, Closed Sets
7. [4/17] Lecture 13-14: Compactness, Heine-Borel Theorem; Connected Sets, Cantor Sets
8. [4/24] Lecture 15-16: Convergence of Sequences; Subsequences, Cauchy Sequences
9. [5/ 1] Lecture 17-18: Complete Spaces; Series
10. [5/ 8] Lecture 19-20: Series Convergence Tests; Functions - Limits and Continuity
11. [5/15] Lecture 21-22: Continuous Functions; Uniform Continuity
12. [5/22] Lecture 23-24: Discontinuous Functions; The Derivative, Mean Value Theorem
13. [5/29] Lecture 25: Taylor's Theorem; Sequences of Functions; Brouwer Fixed-Point Thm
14. [6/ 5] Final Exam